

Calculus at Furman: Advice, Suggestions, Resources*

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Introduction

Welcome to the wonderful world of calculus at Furman. In order to help you get the most out of your calculus courses, we have prepared the following to help you make better use of your study time and to make you aware of some of the resources available for help, if you need it.

Advice

Calculus is likely to require that you make a substantial investment of TIME. Probably a minimum of two to three hours outside class for every hour you spend in class. Build this into your life. You should work on it some everyday, whether you have class or not and whether anything is due or not. One of the advantages of mathematics is that it can be done virtually anywhere, anytime. You can use time when you are in the shower or waiting in line to be thinking about problems or going over new concepts in class.

One of the best ways to learn anything is to explain it to someone else. Working in groups is a good way to provide yourself with this opportunity. You can also amaze your friends with careful explanations of, say, all of the different interpretations of the concept of a derivative.

Math is not a spectator sport. You will need to actively participate, roll up your sleeves and get that pencil moving. You will also need to move your brain. Expect to have to think about concepts and problems. Some of the problems you will encounter will teach you new techniques: like playing

*This page was adapted by Mark Woodard from a file made available on the Internet by Susan Hermiller, Melanie Martin, and Eric York of New Mexico State University.

scales in a musical instrument, or running laps around a track. You might not see the point immediately, but they are strengthening you so everything will come together when it counts. Think of them as push-ups for the brain and practice them often. Some problems will require you to think hard and pull concepts together (at this point you will be glad you did your push-ups). Take some time with them, talk about them, take breaks if you are getting frustrated, ask for help if you are stuck, enjoy the process: you are learning.

If you have recently come from high school, even if you have had calculus in high school, expect this to be different. There are likely to be more, better prepared students here than in your high school, but remember that you are trying to learn calculus and not competing with other students. Expect to have to do more work and for the course to move at a faster pace.

This course will likely require a greater degree of self-sufficiency and independence as compare with your high school mathematics courses. Thinking and understanding concepts will be emphasized here.

Many problems which require calculus cannot be solved with simple application of a “formula”. To paraphrase Albert Einstein, “The only thing you absolutely must know is the location of the library.” In your situation this means you will probably always be able to find the formula you need somewhere. However, you will need to be able to set up your problems so that you know exactly what it is that you need! Since you will probably take more courses (depending upon your major) which utilize the concepts from this course, it will be especially important to understand what is useful or applicable in a particular context. This is why understanding the process for solving a particular type of problem is emphasized over memorizing formulas. In most cases, if you understand the concepts, memorizing a formula becomes completely unnecessary because you construct the necessary tools when needed.

Now for some concrete suggestions:

1. Classes are held for your benefit. If attending class wasn't important, all college courses would be by correspondence, and your tuition would be much lower! During class your instructor will go over examples, which are important, and most likely not in the book. It often helps to have a new concept explained in several different ways; the book and the lecture are two different ways which are readily available. Information about quizzes, exams, and due dates is often given out in class. This will help you pace your studying. Calculus courses are sequential, so the stuff you see in math 11, for example, will enable you to make sense of a lot of the stuff you will see in math 12. As one

instructor was heard to say, “Everything you have learned since you were three can be used in this class.” Hence you will not be helping yourself if you “cram” right before an exam and forget the material immediately afterward. As instructors, we note a definite correlation between grades and class attendance. (Come to office hours if you do not understand this last sentence.) What’s the point? **GO TO CLASS!!**

2. The plethora of information to be found in your textbook is astounding. One might even say it covers nearly everything you need to learn in calculus in one form or another. However, math books are not meant to be read like novels (even though they are often exciting and dramatic). It is generally best to read the sections of the book to be covered in lecture through quickly to get some idea of what is there before going to lecture. After the lecture read through it carefully, with pencil and paper in hand, working through examples in detail and taking notes. Make a list of questions to ask in office hours or at the next lecture. One thing to bear in mind while reading your text is that the result of an example is often secondary to the process used in obtaining the result. This is one reason you should be sure you understand all the details the author left out (most likely intentionally). Also, many techniques for solving problems are displayed elsewhere than in examples, so read all of the appropriate section. Even though it sometimes may not seem to be the case, the text does give the tools to do the homework problems.
3. Just as you must play a lot of basketball (or Tetris) to be good at it, you must DO a lot of Calculus in order to be successful. At minimum, work every problem your instructor suggests. If you are having trouble or want more practice, work other problems in that section or get another book and work problems out of it. Most texts also have “additional” or review problems at the end of each chapter. These may or may not be arranged by section. If you are having trouble getting a correct answer to a problem, think about what is going wrong, that way you can learn something new and prevent yourself from making the same error in the future. Don’t settle for a correct answer that you don’t understand.

Work problems more than once: a good way to start off a study session is to start by working some problems from the last few assignments. Work problems until you can do them quickly and they become your

friends. You can even name the most difficult ones. When reviewing or re-doing a problem, think about why you take the steps you do, rather than simply repeating the problem in a robot-like fashion. Remember, the process is usually more important than the result.

The fastest way to get into trouble in calculus is to not do the homework. Remember, similar problems will probably show up on quizzes and exams, where you will be expected to work them quickly and accurately, probably without the book in front of you. Also remember that you will get more out of your homework time if you minimize distractions, i.e., turn the TV or stereo off.

4. Contrary to many students' opinions, your instructor wants you to succeed. Extremely rare is the instructor who will intentionally put completely different material on an exam than what was covered in class. For this reason, pay attention to your instructor and take notes. Then READ your notes and be sure you understand them, filling in any missing details. Use your notes as well as the text when doing homework. Review your notes regularly and pay attention to the comments your instructor writes on your work. Read carefully all supplemental material provided by your instructor. Remember that if your instructor thinks an example is important enough to do in class, or takes the time to prepare a handout, it may also be of sufficient importance to test you on it.
5. Quizzes and exams can be the bane of your existence, or they can be showcases of your mastery of the material. When studying for them, work every homework problem assigned in the sections to be covered (more than once!), paying special attention to why you take the steps you do, and why it works. Review and work through examples in your notes and the text, again with particular emphasis on the process being used. Each section of your text has a central idea or concept. In many cases, this central idea depends in some way on an elementary concept with which you are already familiar. For example, finding volumes of some solids is simply an extension of finding areas of some geometric shapes that you already know. If you are able to explain exactly what the "nugget" of a section is and on what basic "stuff" it depends, chances are you are well on your way to a good understanding of the material at hand.

Getting Help

Working in groups can be of enormous help in understanding calculus concepts. One of the best ways to gain understanding yourself is to attempt to explain it to others. Also, many times one student will “see” one problem, while another will “see” a different problem. In this way, people working together can benefit from having access to several different viewpoints. Form study groups with your classmates.

Every instructor has office hours during which you can seek the help you need. Make use of them. You can gain valuable insight into difficult material as well as the material your instructor considers the most important. Frequently instructors suffer from depression as a result of the lack of students during office hours, so consider it your humanitarian duty to go see your instructor during these times. It might even help you! If you have a time conflict with your instructor’s hours, ask to make appointments. Your instructor will nearly always be glad to oblige.

During the term there are scheduled help sessions usually 4 nights per week. Ask your instructor for the hours during the current term. These are usually held in the Math MRC, room 101 in Riley. Also, there are hours during the day when the MRC is staffed by someone who could offer help.

Study guides and solutions manuals can be helpful. However, be warned that they can also be a trap, for they are no substitute for working problems out for yourself. Use sparingly and as a last resort, after truly attempting to solve a problem yourself. The solutions manual is usually held on reserve in the library.

Student Services is another resource which may be helpful. They provide free tutoring in many cases. Also, you can get a list of people willing to tutor for money from the mathematics department secretary Mickey Fray in the mathematics office, Riley 205.